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LISTS OF SPECIES

# Checklist of Recent *Cylindriscala* (Caenogastropoda: Epitoniidae) of the World

Silvio Felipe Barbosa Lima * and Martin Lindsey Christoffersen

Universidade Federal da Paraíba, Campus I, Departamento de Sistemática e Ecologia. CEP 58059-900. João Pessoa, PB, Brazil.
* Corresponding author. E-mail: *sfblima@yahoo.com.br*.

**ABSTRACT:** A checklist of deep water gastropods belonging to the genus *Cylindriscala* is presented based mainly on data from the literature. We list a total of 21 species and include information on the geographic and bathymetric distribution of each taxon. The generic position of eight species previously included in this genus is questioned and requires a review.

## INTRODUCTION

The genus *Cylindriscala* de Boury, 1909 includes epitoniids restricted to deep waters (Bouchet and Warén 1986). It is characterized by a turriculate, tall, slender shell, rounded teleoconch whorls sculptured with strong, wide (non-lamellar) axial ribs and a strongly developed basal disc (Clench and Turner 1952; Bouchet and Warén 1986; Weil *et al*. 1999; García 2005). Anatomical and molecular studies have not yet been done to evaluate if the group is monophyletic.

The first species referred to the genus *Cylindriscala* were described and reported for the Atlantic Ocean (Verrill 1882; Watson 1883; Filhol 1886; Tryon 1887; Dautzenberg and de Boury 1897a, b). In the late nineteenth century, Smith (1891) described *Cylindriscala distincta* from the western Pacific, but the recognition of a large number of species in the Pacific and Indian Oceans only occurred with Schepman (1909) and Thiele (1925). These authors described their species in the genus *Scalaria* Lamarck, 1801 or *Scala* Mörch, 1852. Recently, Weil *et al.* (1999) based on examination of the photographs of type material, tentatively referred such taxa to the genus *Cylindriscala* (Mr. Leonard Brown - personal communication, February 2012). Bouchet and Warén (1986) reviewed epitoniids and nystiellids from the bathyal region of the northeastern Atlantic, referred a number of species to the genus *Cylindriscala* and described two new species to science. Sporadic records of the group have since appeared in Japan, the Philippines, Indonesia, Oceania, Polynesia, New Caledonia (Higo *et al*. 1999; Weil *et al*. 1999; García 2003) and the USA (García 2005).

More than half of the known species of *Cylindriscala* have been described for the Atlantic Ocean (Weil *et al*. 1999; García 2005). However, the group has been very poorly sampled in the western Atlantic, with only three previously reported species (Verrill 1882; Clench and Turner 1952; Bouchet and Warén 1986; Wiggers and Veitenheimer-Mendes 2003; García 2005; Rosenberg *et al*. 2009). Moreover, the record of *Cylindriscala acus* from the western Atlantic is considered somewhat dubious (Bouchet and Warén 1986).

This paper lists current knowledge of the biodiversity of Recent species of *Cylindriscala* and summarizes information on geographic/bathymetric distribution, providing the references from which the data were obtained.

## MATERIALS AND METHODS

A checklist of the species of the genus *Cylindriscala* worldwide and their geographic and bathymetric distribution is presented based on data from the literature. A generic evaluation of the shell morphology of each species listed was performed. Gofas *et al.* (2001) and Rosenberg (2009) were consulted for a cross check of the species richness and distribution references.

## RESULTS AND DISCUSSION

A review of the literature and available databases resulted in records of 21 recent species of *Cylindriscala* worldwide. Of these species, eight were tentatively referred to *Cylindriscala* (Weil *et al*. 1999), but their generic placement is rather questionable and in need of further research and inquiry (Mr. L. Brown - personal communication, February 2012). These species are listed here with a question mark [?] and this study is not intended to review them.

Members of the genus *Cylindriscala* are known to inhabit continental and island slopes in the Atlantic, Pacific and Indian oceans at depths from 200 to 2950 m (Smith 1891; Bouchet and Warén 1986; Weil *et al*. 1999), occurring only rarely on continental shelves (Wiggers and Veitenheimer-Mendes 2003).

Only *Cylindriscala aequatorialis* has been considered here to have been reported from deep waters of the Indian Ocean, being known from its type locality off East Africa (Thiele 1925; Weil *et al*. 1999).

Currently, we recognize the existence of two *Cylindriscala* species in the Pacific Ocean (Weil *et al*. 1999; García 2003) and ten species in the Atlantic Ocean (Clench and Turner 1952; Bouchet and Warén 1986; Esteban and Sanchiz 1997; Weil *et al*. 1999; Hernández-Otero and Garcia 2003; Wiggers and Veitenheimer-Mendes 2003; García 2005). The Pacific and Atlantic oceans do not present a comparable species richness of *Cylindriscala*, even when each ocean is taken into consideration separately (Weil *et al*. 1999; García 2003; 2005).

In the Pacific Ocean, records of the genus *Cylindriscala* are here restricted to Indo-Malaysia and Australia (Weil *et al*. 1999; García 2003). The geographic distribution of the species in these areas is rather poorly known and represented by only a few specimens collected at depths of about 200 to 750 m (Weil *et al*. 1999; García 2003). To date, there is no information on the occurrence of species of *Cylindriscala* in the eastern Pacific.

The greatest known diversity of *Cylindriscala* is found in the northeastern Atlantic (Bouchet and Warén 1986; Weil *et al*. 1999), which contrasts with the complete absence of the genus in other parts of the Atlantic Ocean (*e.g.*, West Africa and a large portion of South America) (Clench and Turner 1952; Weil *et al*. 1999; Wiggers and Veitenheimer-Mendes 2003; Rios 2009). The bathymetric distribution known for the taxa collected in this ocean ranges from 100 to 2950 m (Bouchet and Warén 1986; Wiggers and Veitenheimer-Mendes 2003).

*Cylindriscala tortilis*, *C. rosenbergi* and *C. andrewsii* inhabit the upper continental slope of the western Atlantic, with the former two known only from the area in which they were originally collected (Clench and Turner 1952; García 2005). On the other hand, *Cylindriscala andrewsii* is spread over a broad geographic area, significantly expanding the occurrence of the group in the south Atlantic (Brazil – state of Rio Grande do Sul), but still leaving a largely disjunct area between the West Indies and southeastern Brazil (Wiggers and Veitenheimer-Mendes 2003; Rios 2009).

In general, species of *Cylindriscala* are poorly known in many marine regions worldwide. However, this does not reflect the actual biodiversity of the group. More species are certainly waiting to be discovered worldwide.

Family Epitoniidae Berry, 1910

Genus *Cylindriscala* de Boury, 1909

*Cylindriscala acus* (Watson, 1883)

Distribution: Eastern Atlantic – Portugal, Canary Islands (Spain) and Archipelago of the Azores (Portugal) [785-2200 m] (Clench and Turner 1952: 333-334, pl. 161, figs. 5-6; Abbott 1974: 117; Bouchet and Warén 1986: 531, figs. 1117, 1128, 1229, 1236; Weil *et al*. 1999: 34, fig. 82; Gofas *et al*. 2001; Hernández-Otero and Garcia 2003: 85).

Watson (1883; 1886: 140) reported *Cylindriscala acus* on both sides of the Atlantic Ocean. However, Bouchet and Warén (1986: 531) were unable to locate the specimens collected by the *Challenger* in the West Indies. While numerous studies continued to recognize the taxon in the western Atlantic (Clench and Turner 1952: 334; Abbott 1974: 117; Hernández-Otero and Garcia 2003: 85; Rios 2009: 184), including the Brazilian coast (Rios 2009: 184), these records were based primarily on the description and illustration of the original publication. Thus, this species still needs to be confirmed for the western Atlantic based on the examination of new material (Rosenberg 2009).

*Cylindriscala aequatorialis* (Thiele, 1925)

Distribution: Western Indian Ocean – Somalia [continental slope] (Thiele 1925: 136, pl. 11, fig. 7; Weil *et al*. 1999: 86).

*Cylindriscala andrewsii* (Verrill, 1882)

Distribution: Western Atlantic – off New Jersey, Florida, Mexico, Cuba, Brazil (Rio Grande do Sul) [100-914 m] (Verrill 1882: 526-527, pl. 57, fig. 35; Clench and Turner 1952: 335-336, pl. 162, figs. 1-2; Abbott 1974: 117, fig. 1214; Weil *et al*. 1999: 14; Wiggers and Veitenheimer-Mendes 2003: 58; Rios 2009: 183, fig. 446; Rosenberg *et al*. 2009: 641).

*Cylindriscala aurantia* Bouchet and Warén, 1986

Distribution: Eastern Atlantic - Archipelago of the Azores (Portugal) [2085-2095 m] (Bouchet and Warén 1986: 534, fig. 1242; Weil *et al.* 1999: 34, fig. 83; Gofas *et al*. 2001).

*Cylindriscala distincta* (Smith, 1891)

Distribution: Western Pacific – Australia [200 to depths down to 750 m] (Smith 1891: 441, pl.35, fig. 15; Higo *et al*. 1999: 130, fig 404; Weil *et al*. 1999: 130, fig 404).

*Cylindriscala? enamelis* (Kuroda in Nakayama, 1995)

Distribution: Western Pacific - Indo-China: Japan [continental slope] (Weil *et al*. 1999: 118).

*Cylindriscala guernei* (Dautzenberg and de Boury, 1897)

Distribution: Eastern Atlantic – Portugal and Archipelago of the Azores (Portugal) [1100-2005 m] (Jeffreys 1884: pl. 10, fig. 8; Dautzenberg and de Boury 1897a: 33; 1897b: 71, pl. 2, figs. 6-7; Dautzenberg 1927: 152, pl. 4, fig. 25; Bouchet and Warén 1986: 532, figs. 1127, 1231, 1239-1240; Weil *et al*. 1999: 34; Hernández-Otero and Garcia 2003: 85).

*Cylindriscala? humerosa* (Schepman, 1909)

Distribution: Western Pacific - New Caledonia and Polynesia [416-1570 m] (Schepman 1909: 227, pl. 14, fig. 7; Weil *et al*. 1999: 86, fig. 255; García 2003: 11-12).

*Cylindriscala jeffreysi* (Tryon, 1887)

Distribution: Eastern Atlantic – Portugal, Canary Islands (Spain) and Archipelago of the Azores (Portugal) [1187-1800 m] (Jeffreys 1884: 139, pl. 10, fig. 9; Tryon 1887: 62; Dautzenberg and de Boury 1897a: 32; 1897b: 67, pl. 2, figs. 3-4; Dautzenberg 1927: 151, pl. 4, figs. 23-24; Bouchet and Warén 1986: 536, figs. 1230, 1243; Weil *et al*. 1999: 34, fig. 84; Gofas *et al*. 2001).

*Cylindriscala? lirulata* (Thiele, 1925)

Distribution: Eastern Indian Ocean – Teressa and Katchall Islands [continental slope] (Thiele 1925: 139-140, pl.11, fig. 16; Weil *et al*. 1999: 86).

*Cylindriscala mirifica* (Fischer in Filhol, 1886)

Distribution: Eastern Atlantic – Canary Islands (Spain) and Archipelago of the Azores (Portugal) [2000-2950 m] (Locard 1897a: 2; 1897b: 399, pl. 18, figs. 27-30; Bouchet and Warén 1986: 536, figs. 1244-1245; Weil *et al*. 1999: 34, fig. 85; Gofas *et al*. 2001; Hernández-Otero and Garcia 2003: 85).

*Cylindriscala? nitida* (Kuroda and Itô, 1961)

Distribution: Western Pacific - Indo-China [continental slope] (Weil *et al*. 1999: 118, fig. 372).

*Cylindriscala? orientalis* (Thiele, 1925)

Distribution: Western Indian Ocean - East Africa [continental slope] (Thiele 1925: 136-137, pl.11, fig. 8; Weil *et al*. 1999: 86).

*Cylindriscala paradoxa* García, 2003

Distribution: Western Pacific - Indo-Malaysia: Philippines [640-668 m] (García 2003: 12).

*Cylindriscala rosenbergi* García, 2005

Distribution: Western Atlantic – USA: Alabama [400-490 m] (García 2005: 79-80, figs. 1-3; Rosenberg *et al*. 2009: 641).

*Cylindriscala? sibogae* (Schepman, 1909)

Distribution: Western Pacific - Indonesia [continental slope] (Schepman 1909: 227-228, pl.14, fig. 8; Weil *et al*. 1999: 86, fig. 258).

*Cylindriscala? solar* (Nakayama, 1995)

Distribution: Western Pacific - Indo-China: Japan; Oceania: Fiji [continental slope] (Higo *et al*. 1999: 177; Weil *et al*. 1999: 118; García 2003: 11).

*Cylindriscala thalassae* Bouchet and Warén, 1986

Distribution: Eastern Atlantic - Bay of Biscay [1000-1055 m] (Bouchet and Warén 1986: 534, fig. 1241; Esteban and Sanchiz 1997: 165; Weil *et al.* 1999: 34, fig. 86; Gofas *et al*. 2001).

*Cylindriscala tortilis* (Watson, 1883)

Distribution: Western Atlantic – Culebra Island (Puerto Rico – West Indies) [713 m] (Watson 1883: 607; 1886: 139-140, pl. 9, fig. 1; Clench and Turner 1952: 334, pl. 161, figs. 1-2; Abbott 1974: 117; Bouchet and Warén 1986: 534; Weil *et al*. 1999: 14).

Clench and Turner (1952) recognized this species as belonging to the genus *Cylindriscala*. Abbott (1974) later classified this taxon as *Opalia* (*Cylindriscala*) *tortilis* (Rosenberg 2009). However, subsequent studies and databases continued to recognize *Cylindriscala tortilis* (Bouchet and Warén 1986: 534; Weil *et al*. 1999: 14). Based on shell characters, the genus *Cylindriscala* is considered here the most appropriate assignation for the taxon.

*Cylindriscala? turrita* (Nakayama, 1995)

Distribution: Western Pacific - Indo-China: Japan [continental slope] (Weil *et al*. 1999: 118).

*Cylindriscala vicina* (Dautzenberg and de Boury, 1897)

Distribution: Eastern Atlantic – Portugal and Archipelago of the Azores (Portugal) [1100-2005 m] (Dautzenberg and de Boury 1897a: 33; 1897b: 72, pl. 2, figs. 8-9; Dautzenberg 1927: 159, pl. 4, figs. 33-34; Bouchet and Warén 1986: 531, figs. 1129, 1237-1238; Weil *et al*. 1999: 34; Gofas *et al*. 2001).

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